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ANNUAL REPORT FOR FISCAL YEAR 1949

Environmental Health Center
Cincinnati, Ohio

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FEDERAL SECURITY AGENCY

Public Health Service

ENVIRONMENTAL HEALTH CENTER

Cincinnati, Ohio

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ANNUAL REPORT

For

FISCAL YEAR 1949

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ANNUAL REPORT

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FOREWARD

This report has been prepared for administrative use within the Public Health Service and should not be published. Many of the findings described herein are of a tentative or preliminary nature, subject to further study and investigation.

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FEDERAL SECURITY AGENCY

Public Health Center

ENVIRONMENTAL HEALTH CENTER

Cincinnati, Ohio

ANNUAL REPORT FOR FISCAL YEAR 1949

SUMMARY

During 1949, the Water and Sanitation Investigations Station, which had been active in sanitary engineering research for over thirty years, was redesignated the Environmental Health Center. The principal functions of the Environmental Health Center are: (1) to conduct practical research studies and field investigations for the development and improvement of procedures and methods designed to eliminate or reduce health hazards of the environment; (2) to make available to health agencies the results of such research and investigations, and to provide training for health personnel in the operating procedures of environmental sanitation; (3) to conduct studies and field investigations of specific environmental health problems in cooperation with State health and other agencies. Such studies and research require a teamwork approach utilizing experts in medicine, engineering, bacteriology, chemistry and other specialized fields.

Activities of the Center expanded in 1949 due principally to cooperative studies in connection with water pollution control problems. The Shellfish Laboratory at Woods Hole, Massachusetts, was transferred adminis-

tratively to the Center. The Center cooperated with the Public Buildings Administration in the initiation of design for a new laboratory building in Cincinnati authorized for construction by the Congress in 1948, to replace and consolidate the existing inadequate facilities.

The Center continued to supply extensive consulting service to State health departments and other official agencies on special environmental health problems. Cooperation with the Atomic Energy Commission was continued on studies of treatment and disposal of radioactive wastes both at the Center's laboratories and at Commission installations. Activity continued in the development and improvement of professional standards and procedures through the operating program and representation of the Center staff on twenty-seven official and professional committees organized for such purposes.

Water Research

Studies of specific bacterial organisms useful as indicators of water pollution continued throughout the year. Comparisons of coliform and enterococcus organisms indicate that both indices of pollution have value in determining degree of freshness of pollution. In connection with standard criteria for bacteriological quality of drinking waters, a study of the number of coliform bacteria producing the first sign of gas in lactose broth tubes indicated that there is no basis for the requirement that 10% or more gas be produced before the result is significant. A brief study of railway passenger car toilet contamination of roadbeds indicated greatest contamination at large terminals as contrasted to lesser hazards on the open track and at way stations.

Biological activities were expanded and experimental studies were undertaken on the development of bio-assay procedures for determining the toxicity of industrial wastes to fish and other aquatic life.

The household sewage disposal investigation project undertaken in cooperation with the Housing and Home Finance Agency was reactivated in January and intensified to include studies of ground absorption of sewage effluents as well as of the various types of septic tanks. A report on previous work, issued in October, indicated an advantage in efficiency for multiple, rather than single, compartment septic tanks of the same capacity. Cooperation was extended to States and other agencies in revision of the health regulations pertaining to septic tank system design and construction.

Improved staining procedures have been developed for direct microscopic examination of bacteria in milk and other bacterial standards for milk have been under study. Procedures for testing quaternary ammonium compounds and other germicides used for disinfection of utensils and dishes in restaurants and other food handling establishments were distributed to a large number of interested health agencies. Local health agencies are much concerned with the control of these compounds, some of which are rendered ineffective by dissolved minerals in local water supplies.

Considerable study has been made during the year and is continuing on the effects of various industrial wastes, including fluorides, cobalt, chromium, and cyanide, on the natural purification of polluted waters; also of the Biochemical Oxygen Demand test, the standard method of measuring the capacity of sewage and wastes for depletion of oxygen in receiving wastes. Improved procedures for analysis of fluoride, citric acid, ammonia nitrogen and nitrate nitrogen in water have been developed. In relation to treatment methods for certain industrial wastes, the activated sludge process indicates that such sludges can be satisfactorily maintained on feeds other than sewage and that

concentrations of up to 500 p.p.m. of fluoride, 5 p.p.m. of copper and 500 p.p.m. of citrate do not adversely affect such sludges.

Tastes and odors in public water supplies have been a source of widespread concern in many sections of the country in recent years. Control procedures have been difficult and only partially successful. Studies have been initiated to develop a new procedure by which the responsible substances, present in the waters in only minute concentrations, may be concentrated, separated, and identified as a preliminary to determining control methods. In this investigation, adsorbent filters installed in the water systems at various cities are returned to the laboratory and the adsorbed substances extracted and separated. A wide variety of organic chemicals of natural and man-made origin have already been identified.

Research on bacteria in shellfish and shellfish growing waters indicate that contamination is greatly reduced in a relatively short time when the shellfish are transplanted from polluted to clean sea water. During winter conditions, shellfish may concentrate contamination to more than ten times the pollution present in the overlying waters.

The 1945 Inventory of Water and Sewage Facilities in the United States was printed and distributed to requesting agencies; supplementary information is currently being collected and maintained for publication of an inventory for 1950.

Field Investigation

The field work on the water pollution survey of the Niagara River, undertaken under the auspices of the International Joint Commission set up under treaty between the United States and Great Britain, was completed during the year in cooperation with the Canadian National Department of Health and

Welfare and the State of New York. On the similar cooperative international studies on the St. Marys River, and the connecting waterways between Lakes Huron and Erie, Public hearings were held by the Commission for review of the technical data and findings by affected municipalities and industries and the final report to the Commission was largely completed.

The pollution survey of the Kansas River, undertaken in cooperation with the Corps of Engineers, the Bureau of Reclamation, and the States of Kansas and Nebraska, and over which the Center exercised technical direction, was completed and the final report prepared. This comprehensive report will provide a foundation for water pollution abatement and prevention activities in this area for the guidance of the States and the Federal water resource development agencies.

A cooperative study with the Bureau of Reclamation, the State of Colorado, and the City and County of Denver, of water pollution problems in the South Platte River Basin was carried on during the year. This investigation, scheduled for completion in 1950, is important in connection with irrigation water use and future water resource development for this purpose.

A special study has been initiated to determine definitely the health consequences of consumption of vegetable crops grown on lands irrigated with contaminated water and to develop necessary standards of water quality for such use.

At the request of the States of Arkansas and Kansas, a survey of pollution of the Verdigris River with specific reference to the public water supply taste and odor problem in the area, was conducted and a report embodying recommendations for remedial control measures forwarded to the respective States.

The bathing water survey in Lake Michigan in the Chicago area was completed. In these waters of relatively good quality, no effect was found on the incidence of illness which could be attributed to bathing therein, although some areas of the country have more stringent standards of bathing water quality. A similar investigation was begun late in the year in the Dayton-Bellevue, Kentucky, area with respect to recreational bathing in the Ohio River. These and similar future studies are designed to provide an acceptable standard for bacteriological quality of natural bathing waters based upon epidemiological evidence.

Cooperation with the Corps of Engineers was continued in connection with pollution abatement and water quality benefits to be obtained by suitable design and operation of seven specific water impoundment projects in various sections of the country and in connection with the health aspects of other hydraulic control operations of that agency.

Training

A three weeks advanced training course was conducted for State health department supervisory personnel concerned with the laboratory health control of drinking water, milk, and food. An advanced technical course also was carried on for State Engineers engaged in water pollution control programs. These courses were attended by 39 persons from 28 States, Puerto Rico, one interstate agency, the U. S. Army, and one major industry. In addition, special training was conducted for three foreign trainees, one Army officer, and the director of one State laboratory.

ADMINISTRATIVE AND GENERAL

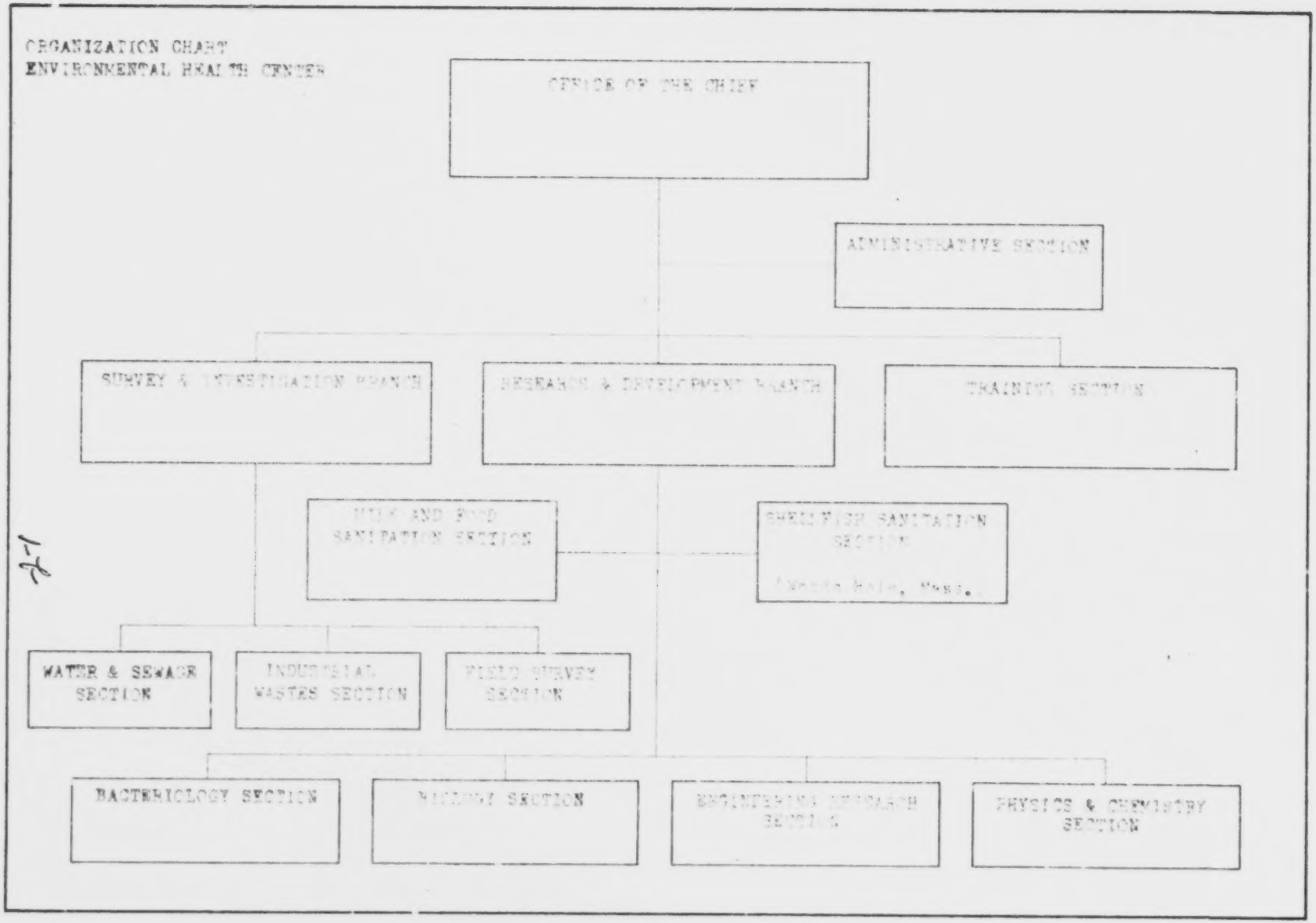
Organization

On April 1, 1949 the Water and Sanitation Investigation Station was redesignated the Environmental Health Center and transferred from the office of the Surgeon General to the Bureau of State Services. This change was accompanied by a broadening of the functions of the Center in the field of applied research and investigation in problems of environmental health. In order to carry out more efficiently into broadened functions and expanded activities, the Center organization was revised to provide for three principal operating subdivisions, concerned respectively with intramural research, field surveys and investigations and training of professional personnel in the environmental health field. This organization is shown on the accompanying chart.

Quarters

In order to provide for the expanded activities of the Center, 30,000 square feet of space on the second floor of the building at 1014 Broadway, Cincinnati, were leased; the executive, training, and field activity offices of the Center were moved to these new quarters in March and the bacteriology and biology laboratories were moved in April and May, respectively. This move released space in the building at East Third and Milgour Streets for the previously overcrowded physics and chemistry laboratories and made possible the initiation of provision for studies on the control of health hazards associated with radioactive wastes. The milk and food sanitation laboratory remains at the Feller Building.

The physical facilities of the Center will not be adequate until


ORGANIZATION CHART
ENVIRONMENTAL HEALTH CENTER
OFFICE OF THE CHIEF
ADMINISTRATIVE SECTION
SURVEY & INVESTIGATION BRANCH
RESEARCH & DEVELOPMENT BRANCH
TRAINING SECTION
MILK AND FOOD SANITATION SECTION
SHELLFISH SANITATION SECTION
Woods Hole, Mass.
WATER & SEWAGE SECTION
INDUSTRIAL WASTES SECTION
FIELD SURVEY SECTION
BACTERIOLOGY SECTION
MYCOLOGY SECTION
ENTOMOLOGICAL RESEARCH SECTION
PHYSICS & CHEMISTRY SECTION

the new building, authorized for construction, is available and occupied. The functional requirements for the design of specific laboratories and office space have been given careful consideration and close liaison maintained with the Public Buildings Administration in connection with the design of the new building. The construction plans and specifications were approximately 20% complete at the close of the fiscal year.

Personnel

Associated with the increased functions and activities of the Center and the need for a prompt attack on the problems of water pollution and other phases of environmental health, the professional staff at the Center was gradually expanded during the year. The following tabulation shows the personnel on duty each month of the fiscal year by category as compared with June 1948, the last month of the previous fiscal year. It includes personnel assigned to all activities under the administrative control of the Center.

Classification	July '48	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. '49	Feb.	March	April	May	June
Regular Corps:												
Sanitary Engineers	8	8	7	10	12	12	15	15	15	15	1[illegible]	1[illegible]
Scientists	3	3	2	3	3	3	3	3	3	3	3	3
Reserve Corps:												
Sanitary Engineers	5	6	6	6	7	7	6	6	6	6	6	5
Sanitarians	2	2	3	3	3	3	3	3	3	3	3	3
Civil Service Personnel:												
Professional	19	21	20	20	22	25	28	29	31	33	32	32
Sub Professional	12	16	16	15	18	19	20	20	20	20	20	35 *
Administrative	5	5	5	6	6	6	6	6	6	6	6	6
Clerical	12	13	13	13	14	14	15	16	15	15	16	15
Custodial and Messenger	10	9	9	9	11	12	13	14	13	13	13	13
Totals	76	83	81	85	96	101	109	112	112	114	117	130

* Includes 15 employees who entered on duty 6/27/49 (Bathing Beach Survey)

Personnel (Cont'd)

Commissioned Officers

Oral and written examinations were held for junior assistant and senior assistant engineer applicants for the Regular Corps.

Transferred to the Center:

Senior Scientist C.M. Tarzwell

Sanitary Engineer Graham Walton

Sanitary Engineer John S. Wiley

Sanitary Engineer Roscoe H. Gocke

Assistant Sanitary Engineer Irvin P. Sender

Engineer (R) E. P. Dubuque

Engineer (R) Roy Ronori

Sanitary Engineer (R) James L. Dallas

Assistant Sanitary Engineer G. E. McDermott

Transferred from the Center:

Sanitary Engineer F. E. DeMartini

Senior Assistant Sanitary Engineer D. J. Schliessmann

Commissioned in the regular and reserve corps in the grades indicated:

C. C. Ruchhoft - Senior Sanitary Engineer

H. H. Black - Sanitary Engineer

P. D. Haney - Sanitary Engineer

E. P. Dubuque - Sanitary Engineer

S. R. Weibel - Senior Assistant Sanitary Engineer

D. J. Schliessmann - Senior Assistant Sanitary Engineer

I. P. Sender - Assistant Sanitary Engineer

Mary E. Fulmer - Junior Assistant Sanitary Engineer

G. R. Schultz - Junior Assistant Sanitary Engineer

J. P. Sheehy - Junior Assistant Sanitary Engineer

E. C. Taivoglou - Assistant Sanitary Engineer (R)

Promoted to the grades indicated:

A. H. Stevenson - Senior Sanitary Engineer

E. P. Dubuque - Senior Sanitary Engineer

G. R. Weber - Scientist (bacteriologist)

M. B. Ettinger - Scientist (chemist)

F. M. Middleton - Scientist (chemist)

G. E. Terhoeven - Sanitarian (R) (chemist)

N. N. Norman - Sanitarian (R) (bacteriologist)

G. G. Roebeck - Senior Assistant Engineer (R)

Placed on inactive duty:

James L. Dalles - Sanitary Engineer (R)

Civil Service Professional Personnel

Transferred to the Center:

C. P. Carnahan - Public Health Engineer P-5

Elsie Wattie - Bacteriologist P-5

Transferred from the Center:

Francis E. Lenzen - Public Health Engineer P-1

New Appointments:

L. R. Setter - Chemist P-6

H. P. Kramer - Chemist P-5

F. J. Ludzack - Chemist P-4

John M. Wilson - Aquatic Biologist P-4

T. W. Bendixen - Soil Scientist P-4

Morton Bork - Chemist P-3

O. T. Williams - Chemist P-3 *

H. L. Krieger - Chemist P-3

Max Katz - Aquatic Biologist P-3

W. Arnold - Bacteriologist P-3

John B. Owen - Aquatic Biologist P-3

Henry Bowen - Chemist P-2

William T. Van Patten - Bacteriologist P-1

Alton E. Bryant - Bacteriologist P-1

Julianne Papageou - Chemist P-1

Edwin B. Goldbrich - Bacteriologist P-1

George W. Maloney - Bacteriologist P-1

*Inter-Agency transfer

Promoted to grades indicated:

L. A. Black - Bacteriologist P-6

H. F. Clark - Bacteriologist P-4

Edwin B. Goldbrich - Bacteriologist P-2

Separation:

A. M. Henson - Chemist P-3

Edward J. McKenzie, Jr. - Chemist P-1

Special Activities

Greater emphasis was placed on the study of radioactive waste disposal during the year. Consultation services were furnished to the Atomic Energy Commission in connection with radioactive waste disposal problems at several of its installations. An engineer and chemist were assigned to the Los Alamos, New Mexico Atomic Energy Commission installation to make special studies of

the treatment of liquid radioactive waste products. Continued technical guidance has been furnished to another engineer-chemist team assigned to the Oak Ridge, Tennessee installation for similar studies.

Two engineers and one scientist officer from the Center attended the six-week course in Radiological Safety given at Edgewood Arsenal. One sanitarian officer attended the school of nuclear studies at Oak Ridge, Tennessee. Sanitary Engineer [illegible] L. Woodward has been assigned to Ohio State University for advanced radiological training.

Senior Sanitary Engineer [illegible] Ruchhoft has been active as a member of the Sanitation Study Section of the Division of Research Grants and Fellowships, P.H.S., which passes upon applications for fundamental research in the field of environmental health.

Considerable attention was devoted to the working out jointly with the Division of Water Pollution Control of a comprehensive water pollution control program and the responsibility of the Center therein. Meetings were held with representatives of State water pollution control agencies to plan cooperative the Center's research program in this field.

A comprehensive investigation of the shore waters of Lake Michigan from Milwaukee, Wisconsin to Michigan City, Indiana, was conducted during the summer. Special studies were made of the illness incidence in two residential areas in Chicago located adjacent to lake bathing areas to determine the relationship between illness among bathers and water quality. A similar study has been initiated on the Ohio River at Dayton and Bellevue, Kentucky.

These two studies are the first of a series to be made in an attempt to establish more definitive bathing water quality standards.

A study of the bacteriological quality of vegetables grown in polluted and unpolluted irrigation waters has been initiated in the Denver, Colorado area. This study is pointed toward the development of sound irrigation water standards and will require an investigation of the epidemiological aspects of the problem for which preliminary plans have been made.

RESEARCH AND DEVELOPMENT BRANCH

During the year, the Research and Development Branch was established to coordinate and direct the activities of the laboratory and engineering research sections.

The major work of this branch is the development and evaluation of analytical methods, studies and development of treatment and other methods and procedures, and the application of research findings to environmental health control problems.

Bacteriology Section

Studies on the efficiency of the coliform and enterococcus groups of bacteria as indices of pollution have been expanded during the year. Results obtained thus far indicate that dual indices of pollution using both the enterococcus and coliform group may aid the interpretation of results. The presence of enterococcus appears to indicate "recent" pollution.

In the standard presumptive coliform test, the number of coliform bacteria present at the first appearance of gas ranged from 40,000,000 per ml. to 396,000,000 per ml., with a mean of 168,000,000 per ml. for six different cultures. The production of gas in the presumptive test in lactose broth at 37°C., even in small quantities, is significant. There is no basis for the previous requirement that 10% or more gas be produced before the result is significant.

A study of railway roadbed pollution by passenger car toilets was conducted in cooperation with the Joint Committee on Railway Sanitation, Association of American Railroads. Coliform M.P.N. values were determined on samples of stream and roadbed drainage waters and on roadbed ballast. The former gave inconclusive results. The results obtained on ballast samples indicated that contamination was most dense in a large terminal, quite high at a short stop station, and relatively low along a rural track.

Studies on the growth of Aerobacter aerogenes in sterile sewage, incubated at 37°C. for 24 hours, indicated that there was considerable correlation between the organic pollution load in the sewage and the concentration of Aerobacter aerogenes after incubation.

Cooperative assistance was provided for the septic tank project in

determining the concentration of formaldehyde required to secure relative sterility of effluent and also of the soil in the disposal beds.

The relationship of the Eijkman reaction to the growth of Aerobacter aerogenes, Escherichia coli and numerous miscellaneous cultures including Staphylococcus aureus, was investigated. One hundred and eight Aerobacter aerogenes cultures were tested and gave negative Eijkman reactions. The same result was obtained with the Staphylococcus aureus and miscellaneous cultures. Preliminary work was done in determining the interrelationship of coliform, enterococcus and Eijkman M.P.N. values on samples of raw sewage, river water and swimming pool water.

A revision of the pure culture record system was completed which resulted in a comprehensive record that is convenient to consult. The collection contains 147 recently purified cultures, classified according to their differential characteristics by the outline method contained in the "Manual for the Pure Culture Study of Bacteria".

The professional staff of the section participated in field studies of the Center, furnished consultative service to State and local health departments, other branches of the Public Health Service, Federal Agencies, and foreign organizations. Its bacteriologists served as lecturers at the two training courses which were conducted at the Center and participated in a short course for water supply and sewage plant operations at the University of Florida.

Biology Section

The Biology Section, which had become inactive for several years due to retirement and resignation of personnel, was reactivated during the year.

Experimental Bio-assay Studies

Experimental studies have been made, directed toward the development and standardization of a new method for controlled oxygenation of liquids in the course of toxicity bio-assays of industrial wastes. These studies involve detailed investigation of reaeration rates and dissolved gas equilibria in experimental aquaria under varying conditions.

While the current studies are still far from complete, it is believed that a promising standardized technique is being developed for the performance of routine toxicity bio-assays of industrial wastes which are troublesome because of volatility and pronounced oxygen demand of their components.

Survey of Literature

The Subcommittee on Toxicity of the Research Committee, Federation of Sewage Works Associations is making a thorough search of the literature on the toxicity of industrial and other wastes to aquatic plants and animals and their effects on the natural purification of streams and the operation of sewage treatment plants. The Biology Section is cooperating with this committee and has taken the responsibility of the survey and critical analysis of the literature dealing with the toxicity of wastes to fishes.

A survey has also been made of the literature on bottom organisms, plankton and biology of sewage treatment.

Standardization of Bio-assay Methods for Determining the Toxicity of Industrial Wastes

A new section of the Toxicity Subcommittee of the Research Committee, Federation of Sewage Works Associations, which is designated as Section III. has been set up under the chairmanship of Dr. Doudoroff. The purpose of this section is to select or to develop, recommended or standard procedures for the evaluation of the acute toxicity of waste waters and their components to fishes. A comprehensive outline of suggested procedures for the bio-assay of toxic wastes has been made and submitted to the committee members for their criticisms and suggestions.

Biological Indicators of Pollution

Lists of plankton and stream bottom organisms were prepared which classified representative organisms into three groups, tolerant or pollutional, facultative and clean water forms. The zones in which they are most usually found were indicated for the tolerant or pollutional planktors. Families of fish were listed as to their relative tolerance of pollutional conditions or their requirements of clean water. These lists of indicator organisms of sanitary significance will serve as guides in the interpretation of biological data secured on pollution surveys.

Survey Methods and Reference Collections

Tentative field and laboratory methods of plankton analyses were prepared and tentative procedures for the taking, picking and analyzing of bottom samples were decided upon. The nucleus of reference collections of fishes, stream bottom organisms and planktors has been set up. These collections will be added to from year to year as representative specimens become

available and are identified.

Plankton and Water Supply Studies

In cooperation with the International Joint Commission survey of the Niagara River a preliminary study was made in October and November to detect the source of certain taste and odor producing substances in water supplies taken from the Niagara River. A series of plankton samples were taken at stations so located across the Niagara River that organisms entering from Lake Erie or produced in backwaters or polluted areas in the river could be detected. The analysis of these samples showed that although certain taste and odor producing plankton were present, they were not in sufficient concentration to cause difficulty at this time. Apparently because of tributary seeding and possible added fertility from sewage pollution, the plankton concentration was greater on the American than on the Canadian side of the river.

Personnel of the section participated in field activities of the Center and two training courses for State professional personnel and extended consultation service to State and Federal Agencies.

Engineering Research Section

Household Sewage Disposal Project

With depletion of funds at the end of fiscal year 1948 and the immediate unavailability of funds from Housing and Home Finance Agency for continuing the work in 1949, the experimental research and field work were suspended late in June, 1948. A small staff consisting of three engineers, one chemist, one clerk-stenographer and one skilled laborer was retained during July and August, 1948 to prepare a report. The staff was further reduced late in August, 1948, to an engineer, a clerk-stenographer and a skilled laborer.

The report, "Studies on Household Sewage Disposal Systems" was completed in October, 1948 in mimeographed form for limited distribution to interested agencies, for review and comment prior to printing. Following receipt of comments, the report was completed and placed with the printers early in March, 1949. Topics reported included: Review of Literature; Survey of Controls and Practices in Some Local Health Units; Study of Experimentally Operated Septic Tanks; Study of Septic Tanks in Field (Sludge and Scum Accumulations); Laboratory Investigation of Yeast, Sludge, as Starters; and of the Effect of Zeolite Softener Salts on Digestion; and a Survey of Information on the Freezing Aspects of Household Sewage Disposal Systems.

In November, 1948, the H.H.F.A. and P.H.S. agreed to resume the study for the remainder of the fiscal year 1949, the work to be jointly financed by the two agencies, and to include further study of compartmentation, study of inlet and outlet appurtenances, research on soil clogging,

and, if feasible, 16 mm motion pictures on selected phases of the work. These studies have been undertaken.

In studying tank inlet and outlet arrangements, an effort has been made to develop at least preliminary trends quickly, by operating the tanks for periods of two days or so, using dye tracers, changing the variables and again operating for a few days. To date, this has developed a comparison of detention characteristics in tanks equipped with various inlet arrangements in the single compartment tank, and various types of opening between compartments in three compartment tanks all in the initial stage of their operating life, without sludge accumulation.

The experimental dosing of soil columns with various effluents tends to show thus far that initial reduction in percolation rates is proportional to the suspended solids applied; subsequently, biological factors appear to take effect, the greater the biological activity the slower the clogging rate. The possibility of substituting 4 inch auger hole percolation tests for the usual foot square holes showed promise on the basis of limited tests. An examination of a local absorption field brought out a number of pertinent points, among them the necessity of giving more consideration to lateral movement of sewage in the soil with the rapid sealing of bottom area, i.e. possibly deeper and narrower trenches; and the usefulness of gravel packing below the tile line in inviting and localizing root penetration in the gravel, to the exclusion of growth in the tile line itself.

Milk and Food Sanitation Section

Comparative Analysis of Milk

The grading system of milk ordinances is based in part upon bacterial analysis of milk samples at appropriate intervals. The actual procedures in making such analyses are those stipulated in Standard Methods for the Examination of Dairy Products. In view of certain changes made in the current edition which may affect the grade of milk, studies were undertaken to reevaluate the equivalent bacterial standards now generally used.

A report summarizing the results of this work was prepared for use in establishing numerical standards for grading milk by the alternative methods of bacteriological analysis. On the basis of this work and a review of the results obtained by others, there appears to be no justification for lowering present dye reduction or plate count standards.

Direct Microscopic Studies

In a study of staining methods for direct microscopic counts of milk samples the Acid-and-Water-Free staining procedure developed in this laboratory gave the highest post-pasteurization counts after storing laboratory pasteurized milk samples for 18 to 24 hours at 4°C. From 80% to 90% of the original number of bacteria in the raw milk were counted in the pasteurized milk, indicating that the prevailing assumption that upon pasteurization many bacteria disintegrate is basically erroneous. The acid-and-water-free stain offers promise for an estimation of the bacterial count of the raw milk from a direct count made on the pasteurized milk. By the use of the acid-and-water-free stain it was also shown that keeping unstained milk films for as long as ninety days does not impair the value of the count originally present. The use of this procedure offers the possibility of

most practical for routine purposes. Results indicated that the introduction of the reagent directly into the staining solution should be tested as a matter of first preference. Reports indicate that the staining procedure is an improvement over previous procedures and inquiries have been received as to whether the principle underlying the B.S.L. staining procedure could also apply to other bacteriological specimens.

Sanitizing Agents

Specific directions for performing a "Laboratory Procedure for Evaluating Practical Performance of Quarternary Ammonium and other Germicides Proposed for Sanitizing Food Utensils" were mimeographed and distributed to each F.S.A. Regional Office and to each State health officer, sanitary engineer, and laboratory director. Copies have been supplied to manufacturers, research workers in other laboratories, and other individuals who have requested this information.

Studies were continued on the germicidal efficiency of quaternary ammonium compounds combined with non-ionic detergents. Limited tests were made to determine the efficiency of "tamol N" as an inactivator for the bactericidal and bacteriostatic action of quaternaries. Limited studies were continued in the development of a "synthetic" hard water simulating natural waters in its antagonistic action against quaternaries to be used for testing purposes in the study on combined detergent-sanitizers. Generally, synthetic waters developed here have shown no greater antagonistic action as have natural waters.

Preliminary studies were made to determine the equivalent bactericidal value of chloramines as compared to hypochlorites, when used for sanitizing utensils. Preliminary studies were made to determining the mini-

mum time of exposure to hot water at 170°F. that would be germicidal. A number of memoranda were prepared for Public Health Service and State and local health officials concerning the sanitizing properties of various compounds about which they had inquired.

Laboratory Surveys

Laboratory surveys were made of several local laboratories examining milk and food intended for interstate shipment. Surveys were made of the environmental sanitation laboratory activities of the State health departments of Arizona, Colorado, Idaho, Oregon, Utah and New Mexico.

Collaborative Studies

Arrangements were completed to participate in the collaborative studies arranged by the associate referee on Phosphatase Tests for the Association of Official Agricultural Chemists on the reliability of the various phosphatase tests. Three phosphatase techniques were used in the examination of the first series of eight different samples of milk which were examined in duplicate by two analysts. Some difficulty was encountered, indicating the need for further investigation in the use of standards employed with instrumental methods of reading results.

Arrangements were completed through the Applied Laboratory Methods Committee of the International Association of Milk and Food Sanitarians, for collaborative studies on plating agars and on stains for the direct microscopic [illegible]. Arrangements were made to have five agars proposed as an improvement over the present Standard Methods agar, prepared in dehydrated form by two manufacturers. Similarly, arrangements were made to have five stains proposed as an improvement over the present Standard Methods

stain submitted to cooperating laboratories. Included among these are the Acid-and-Water-Free Stain and the B.S.L. Stain. Ten laboratories are cooperating in these studies, seven of which are State health department units.

Physics and Chemistry Section

Analytical Methods

During the year studies were made to develop improved analytical methods for the determination of nitrate nitrogen, cadmium, fluoride, chromium, citric acid, and ammonia. Existing methods were checked and modifications were developed to eliminate interference by other elements and compounds.

The results of these studies indicated that: (1) a modification of the cadmium method is applicable to nitrate nitrogen concentrations between 0.05 and 4.0 ppm. (2) the dithizone method for the determination of cadmium in low concentrations is subject to interference by several elements which can be eliminated by the addition of Rochelle salts; however, copper in concentrations above 0.1 ppm, still remains as an interference problem. (3) a more accurate determination for fluoride is obtained by modification of distillation apparatus and elimination of chloride interference with excess silver nitrate (4) modification of the alkaline-bromine method and a potassium permanganate-sulfuric acid oxidation procedure give more accurate results in the determination of chromium than the ethanol-perchloric acid method (5) a tentative method developed for the determination of citric acid (for use in connection with radioactive [illegible] in soil by [illegible] and oxidation of citric acid to [illegible] procedure for this determination has been carried on to give an improved reproducible technique.

A comparison was made of three dichromate methods for the determina-

tion of oxygen consumed. Two of the methods, U.S.P.H.S. and Laval, produced similar consistent results. The Madison method did not.

B.O.D. and Related Studies

The effects of fluoride, cobalt, trivalent and hexavalent chromium, and cyanide on the B.O.D. of sewage dilutions were studied. (1) Fluoride did not appreciably effect the reaction at concentrations of less than 400 p.p.m. Above that figure marked effects were observed. (2) Cobalt in concentrations up to 0.05 p.p.m. had slight effect on the reaction. Concentrations above this figure had an inhibiting effect on carbonaceous oxidation. (3) Chromium in concentrations of 1.0 to 10.0 p.p.m. showed a toxic effect on the 5 day B.O.D. The trivalent was more toxic than the hexavalent form. (4) Cyanide in concentrations up to 0.8 p.p.m. did not effect the reaction. Higher cyanide concentrations showed a direct relationship with the time required for a particular sample to recover. Concentrations above 16 p.p.m. completely inhibited biological oxidation in a 10 day period of observation.

Studies were made of Miami River water to differentiate between the carbonaceous and nitrogenous oxidation phenomena. Heat and acid methods of pasteurization were used followed by reseeding; however, the change in nitrogen balance observed could not account for the difference in B.O.D. between the control and treated sample.

A comparative study was made of the use of distilled water and de-ionized water for use in the preparation of B.O.D. dilution water. The results indicated that de-ionized water shows promise as a substitute for distilled water in this connection. Further study is needed, however.

Radioactive Waste Studies

In connection with the disposal of liquid radioactive wastes, studies

of treatment by biological procedures such as the activated sludge process are being made. As sufficient domestic sewage might not be available at some locations, studies have been made to develop activated sludges through the use of other nutrients such as flours, dextrose, and supplemental minerals. These studies have indicated that: (1) optimum pH range lies between 7.5 and 9.5 (2) solids limit, between 3000 and 3500 p.p.m., (3) amount of synthetic feed, 500 p.p.m., (4) dextrose-flour ratios, 3 to 1 or higher, and (5) tolerances of synthetic sludges to various elements such as fluoride, copper and citrate; 500 p.p.m., 5.0 p.p.m., and 500 p.p.m., respectively.

An engineer and chemist assigned from the Center to the A.E.C. installation at Los Alamos, New Mexico, are continuing study of treatment methods for handling specific liquid radioactive wastes.

Water Quality Studies

In an attempt to detect the sources of tastes and odors in water supplies, studies have been made to develop a new procedure by which the compounds responsible could be separated and identified. In the method under study, the organic compounds in water are adsorbed by activated carbon in small filters devised for the purpose and installed on raw and finished waters in a selected number of public water supplies. The carbon is air dried and the concentrated organic compounds extracted with anhydrous ether.

The types of compounds found to date include various amines, phenols, terpenes, aromatic and aliphatic hydrocarbons, pyridine, and fatty acids. These studies are being continued and further breakdowns of the compounds will be made.

Studies of the dissimilation of phenol under anaerobic conditions indicated that the rate of phenol utilization is not as rapid as it is under aerobic conditions. However, once the proper seed is established, large amounts of phenol can be dissimilated rapidly under anaerobic conditions.

Detergent Studies

Studies of the basic factors of detergency were continued during the year. These studies included (1) speed of washing, (2) effect of washing temperature, (3) repeated soiling and washing, and (4) effect of quaternary ammonium compounds on washing performance of various detergents.

It was found that the detergents rated as "excellent" with a routine three minute wash at 140°F. would in general wash better in less time and at lower temperature than "poor" detergents. The addition of small amounts of surface active agents to alkaline materials was found to improve the washing performance for short washing periods and lower temperatures.

When slides were repeatedly soiled, washed, resoiled over the residual soil, and rewashed, it was found that less soil was removed with each successive cycle.

When as little as 10.0 p.p.m. of any of the eight types of quaternary ammonium compounds tested were present, the washing performance of the alkaline detergents was decreased. None of the combinations of the non-ionic surface active agents, sequestering agents, alkaline detergents and quaternaries tried were "good" detergents.

Miscellaneous

Consulting and laboratory services were furnished to the Army, Atomic Energy Commission, and State and city health departments in connection with sanitary chemistry problems. Members of the staff trained Center personnel for assignment to field investigation laboratory work. Staff members were

active in committee activities of the Federation of Sewage Works Associations and of the National Sanitation Foundation. Mr. Buchhoft was an active member of the Sanitation Study Section of the Division of Research Grants and Fellowships, N.I.H.

Shellfish Sanitation Section

Woods Hole, Massachusetts

On July 1, 1948 the administrative and technical control of this research unit was transferred to the Center. Conferences were held between representatives of the Center, the Shellfish Laboratory and the Division of Sanitation to program the research studies.

Comparative Bacteriological Examinations

A study was continued throughout the year on various organisms present in the natural sea water of Eel Pond in Woods Hole. A sanitary survey was made of Eel Pond which receives considerable pollution from domestic sewage. Analyses were performed throughout all seasons of the year on clams and quahogs found in Eel Pond and on transported clams, quahogs, oysters and mussels, as well as on the overlying waters. Tests consisted of M.P.N. determinations of (1) coliform group (B.C.T.), (2) Escherichia coli (Eijkman modified) and (3) Enterococci group (Winter and Sandholzer). In addition, IMVIC tests and gram stains were made on at least two purified cultures picked from E.M.B. plates of all gas-producing B.C.T. and Eijkman tubes. As a result of this comparative study the Eijkman test was discontinued and the other two continued.

Controlled Pollution Studies

Survival tests of coliforms were conducted in filtered sea water, phosphate buffered water, tap water and waters with varying sources of pollution, prior toxy to conducting experiments with shellfish in controlled pollution studies. Laboratory holding tanks and shellfish flats were constructed and numerous runs were made with and without pollution, using sea water. Winter results indicated that shellfish contained more than ten times the bacterial densities present in the water after being stored in the water for 30 hours.

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The relative degree of pollution observed was clams - highest, oysters - next, and quahogs - least. After 5 days in water with a coliform density of 1,000 to 5,000 per 100 ml. clean sea water was introduced for about 30 hours. All shellfish reduced pollution to permissible amounts within 5 days. In transplanting experiments made in June, shellfish moved from polluted to clean waters showed an increase of pollution for the first 2 hours then a decrease to safe limits in about 30 hours, with some showing low values in as short a time as 8 hours.

Mussel Studies

A mussel study was initiated to determine the effects of harvesting, handling, and transportation upon the shellfish quality. Additional runs will be needed to obtain information on seasonal variations. Many positive presumptive tests failed to confirm, necessitating further experiments with other test media.

SURVEY AND INVESTIGATION BRANCH

Under the reorganization plan of the Center this branch was made responsible for the conduct of field survey and investigation activities.

Field Survey Section

Major projects of the section have included the Kansas River Basin Pollution Survey, completed, the International Joint Commission Boundary Water Pollution Survey, continued, the South Platte River Basin Survey, started, bathing water surveys in areas near Chicago, Illinois, completed, and Cincinnati, Ohio, started, and studies for the Corps of Engineers of pollutional problems incident to reservoir design and construction.

Kansas River Basin Pollution Survey

Technical direction, laboratory and engineering services were furnished to the Kansas River project throughout the year. The survey was initiated in November, 1947, as a cooperative project with the Corps of Engineers, the Bureau of Reclamation and the states of Kansas and Nebraska to determine water needs for water supply and sanitation, to furnish information for the planning of flood control and irrigation projects and to furnish base data for water pollution control programs in Kansas and Nebraska.

Stream sampling and laboratory work was started in December, 1947, and was completed in December, 1948. During the survey three laboratories were in use, at Bonkelman, Nebraska, Smith Center, Kansas, and Lawrence, Kansas. During the fiscal year 1949 industrial waste studies were made at two poultry packing plants to determine the quantity and pollutional characteristics of the wastes discharged.

At the end of the fiscal year the final report on the project had been prepared, reviewed and approved by the cooperating agencies, and placed in

the hands of the printer for reproduction.

International Joint Commission Boundary Water Pollution Survey

Under the terms of Article IX of the treaty of January 11, 1909 between the United States and Great Britain, the governments of the United States and Canada referred the matter of pollution of the international boundary waters, particularly the Detroit and St. Clair Rivers, the St. Marys River and the Niagara River to the International Joint Commission for study and report concerning necessary remedial methods. The technical studies of the United States section were delegated in 1946 to the Public Health Service.

Field work on the St. Marys River was completed before the end of fiscal year 1948. Laboratory work in the Detroit area was completed in August, 1948, and most of the staff and equipment was transferred to Niagara Falls, where survey activities had been initiated in July, 1948. Laboratory field work in the Niagara area continued until June, 1949, when the laboratory was dismantled and the equipment and supplies were returned to Cincinnati.

Preparation of the final report of the boundary waters survey is progressing rapidly and several portions of it should be completed early in the coming year.

South Platte River Basin Survey

A cooperative study with the Bureau of Reclamation, the State of Colorado and the County and City of Denver to determine the existing pollution in the basin and the water needs of the area was initiated in August, 1948. Laboratory facilities were obtained at the State Laboratory at Denver, a Public Health Service laboratory was established at Greeley, Colorado, and a mobile laboratory was used in the Fort Collins, Colorado, and Ogallala, Nebraska,

areas. Sampling of the river and its tributaries was started in October and continued during the remainder of the year. Sampling was curtailed at times because of heavy blizzards in the western plains States during the winter and flood damage to roads and bridges during June.

Plans are being made for a bacteriological and epidemiological study of factors pertaining to methods of transmission of enteric diseases with particular reference to the use of polluted irrigation waters for vegetable crops. Actual field work on this study is expected to start early in the next fiscal year.

Bathing Water Surveys

The field work for the Tri-State Survey of Lake Michigan Waters which was started in May, 1948, was completed in September. This field work included an epidemiological survey of two areas in Chicago to determine any correlation between swimming experience and the incidence of certain types of illness. A preliminary report covering the bacterial quality of shore waters and sanitary surveys of the areas from Milwaukee to Michigan City was completed in May and approximately 600 copies were distributed on request to interested parties.

In June, 1949, a similar study was initiated in the Dayton-Bellevue area in Northern Kentucky with primary emphasis on an epidemiological survey to determine the effect of bathing in the Ohio River in this area and of bathing in certain outdoor pools. Field work on this survey started June 27, 1949.

Corps of Engineer Projects

At the request of the Corps of Engineers studies were made of pollutional problems and of possible increased low flow pollutional benefits for

several flood control projects. These included reservoirs proposed or under construction on the following rivers:

Chattahoochie River, Georgia
Etowah River, Georgia
Westfield River, Massachusetts
Monongahela-Allegheny Rivers, Pennsylvania
Turtle Creek, Pennsylvania
James River, Virginia
Roanoke River, Virginia

Extensive field work, including sample collection and laboratory analysis, was completed and reports written on two other projects for the Corps of Engineers. One project concerned the effect of dumping of material dredged from Rouge River, Michigan, and the other the effect on sanitation of a program for the control of water hyacinth in Florida.

Industrial Waste Section

Much of the work of the section was done in connection with the International Joint Commission survey of the Niagara River and the South Platte River Basin Survey. Flow gaugings and laboratory analysis of composited samples were made of the waste flows of all major industries in the Buffalo-Niagara area.

During August and September a survey was made in the Verdigris River Basin in Kansas and Oklahoma to determine the effect of waste discharges from oil refineries on tastes and odors in municipal water supplies. It was concluded that with both low water temperatures and low stream discharge followed by rising stream discharges water at downstream intake may contain up to 50 p.p.b. of phenol.

A report was prepared on "Preliminary Investigation of Kraft Mill Wastes from Crossett Paper Mills, Crossett, Arkansas, as Related to Ouachita River Pollution in the Vicinity of the Arkansas-Louisiana State Line."

Comprehensive surveys have been made of the technical literature pertaining to the industrial waste problems of the kraft pulp, laundry, petroleum refinery, steel, metal plating and beet sugar industries and work on industrial waste guides for these industries has been initiated.

Water and Sewage Section

The major activity of this section is the continuing inventory of water and sewage facilities of the United States. The complete printed 1945 Inventory of Water and Sewage Facilities of the United States was received and distributed. The 1947 inventory was completed for 33 States and the 1948 inventory for 40 States. It is planned to publish the issue of the inventory for 1950 for general distribution.

To make the inventory information available for statistical study a system of punch cards has been devised. Approximately 10,000 sewage facility cards covering 22 States have been compiled or revised with information contained in the 1947 and 1948 inventories and 5,000 water facility cards have been prepared and coded.

Several special lists of sanitary facilities have been prepared at the request of federal agencies. These have included (a) lists of all public water supplies and populations served classified by source and method of treatment, (b) lists of all community sewerage facilities in the Ohio and Missouri River basins and (c) a list of all communities having activated sludge sewage treatment plants.

The "basic data files" have been brought up to date.

A study was started, and is still in progress, of the types and sources of taste producing substances affecting municipal water supplies taken from the Ohio River. At the request of the Ohio River Valley Sanitation Commission,

aid was given in preparing recommendations concerning the degree of sewage treatment needed in the Cincinnati and Pittsburgh areas, and a report was prepared on oil pollution of the Ohio River relative to navigation.

Training Section

More adequate provision for advanced and refresher training of State health department engineers and scientific specialists in environmental health procedures was developed during the year. Specific provision was made for a training laboratory and other necessary training facilities in the newly rented quarters and the training staff was augmented by the addition of a chemist and clerical assistance.

A three weeks' Advanced Training Course for State Bacteriologists Primarily Concerned with Water or Milk Analyses or Food Utensil Examinations was held from March 21 - April 8, 1949 and a two weeks' Advanced Training Course for Sanitary Engineers in Stream Pollution Abatement Programs was held during the period April 28 - May 6, 1949. The course for bacteriologists was attended by 16 bacteriologists and chemists from 14 State health department laboratories. The course for sanitary engineers was attended by 19 key engineer and chemist representatives of 17 States and the Puerto Rican water pollution control agencies, one sanitary engineer from the U.S. Army, two sanitary engineers from the Ohio Valley Water Sanitation Commission, and one representative of the Ford Motor Company.

Since the section had not been fully staffed, the bulk of the lectures and demonstrations were given by various professional specialists on the Center staff. Special consultants who presented lectures during the courses were:

Name	Title	Address
Dr. John J. Phair	Director of Health	Louisville & Jefferson County Board of Health Louisville, Kentucky
Dr. James B. Lackey	Editor of Blakiston Co.	Philadelphia, Pennsylvania

Name	Title	Address
Mr. Hudson Biery	Director of Public Relations, Cincinnati Street Railway and Chairman of Ohio River Valley Water Sanitation Commission	Cincinnati, Ohio
Mr. A. M. Vieters	Senior Sanitary Engineer	Division of Water Pollution Control, Washington, D.C.
Mr. Charles M. Henderson	Attorney from F.S.A. General Counsel's Office	Washington, D.C.
Mr. R. W. Streeter	Sanitary Engineer Director (Retired) Public Health Service Consultant	Cincinnati, Ohio
Mr. Harry Schrer	Chemist	New York City Health Department

Special schedules were prepared for the following visitors who were given instruction and training in particular phases of the Center's activities by the professional staffs of individual sections:

Name	State or Country	Position & Organization	Period
Dr. F. W. Hartman	California	Dir., San. Sec., Div. of Laboratories	1/3/49 to 1/28/49
Emilio Girocca	Guatemala	San. Engr., Guatemala, C. A.	1/28/49 to 2/1/49
Dr. Karl Eric Jensen	Denmark	Professor, San. Engrg. Univ. of Copenhagen	4/13/49 to 4/22/49
Juan M. Ramos	Maryland	Capt., U.S. Army Chemical Center	4/25/49 to 5/24/49
M. S. Chatterjee	India	San. Engr., Indian Health Service	5/13/49 to 5/17/49

TECHNICAL PAPERS AND REPORTS

Papers Published

(1) Bactericidal Properties of Free and Combined Available Chlorine. C. T. Butterfield. Journal of American Water Works Association, Vol. 40, No. 12, Dec. 1948.

(2) Determining the Bacterial Quality of Water. C.T. Butterfield, Organo de la Asociacion Interamericana de Ingenieros Sanitarios, 2:1 Julio, 1948

(3) Effects of Contemplated Changes in Standard Methods. L. A. Black. Jour. Milk and Food Technol., 11:200-205, (July-Aug.) 1948.

(4) Newly Proposed Staining Formulas for the Direct Microscopic Examination of Milk. P.S. Levine and L. A. Black. Amer. Jour. of Pub. Health, 38: 1210-1218 (Sept.) 1948

(5) Inhibitors for Neutralizing the Germicidal Action of Quaternary Ammonium Compounds, G. R. Weber and L. A. Black. Soap and Sanit. Chemicals, 24: 127 (Sept.) 1948.

(6) Laboratory Procedure for Evaluating Practical Performance of Quaternary Ammonium and Other Germicides Proposed for Sanitizing and Utensils. G.R. Weber and L. A. Black. Amer. Jour. of Pub. Health, 38:1408-1417 (Oct.) 1948.

(7) Relative Efficiency of Quaternary Ammonium Germicides. G.R. Weber and L. A. Black. Soap and Sanit. Chemicals, 24:125 (Oct.) 1948.

(8) Sterilization of Utensils and Utensils in Dairy Establishments. G.R. Weber. Jour. Milk and Food Technol., 11:287-289 (Sept.-Oct.) 1948.

(9) Direct Microscopic Plate Counts of Pasteurized Milk by Carbolfuchsin, Newman-Lampert No. 8, and the Acid-Fast-Methylene-Blue Methods of Staining Procedures. P.S. Levine and L.A. Black. Jour. Milk & Food Technol. 12:68-75 (March-April) 1949.

(10) Studies of Quaternaries as Bactericides. C.T. Butterfield. Jour. Milk & Food Technol., 12:107 (March-April) 1949. (Abstract).

(11) "Sanitation" - Another View. G.R. Weber. Soap and Sanit. Chemicals, 25: 143 (June) 1949.

(12) Variations in B.O.D. Velocity Constants in Sewage Dilutions. C. C. Ruchhoft, O.R.Placak, John F.Kreimer and C.M. Calbot. Ind. & Eng. Chem., Vol. 40, p. 1290 (1948).

(13) Correction of B.O.D. Velocity Constants for Nitrification. C.C. Ruchhoft, O. R. Placak and M. B. Ettinger. Sewage Works Jour., Vol. XX, P. 883, (Sept. 1948).

(14) Efficiency Studies of a Shallow Recirculating Sewage Filter. W.A.Moore, R.S.Smith and C.C.Ruchhoft. Sewage Works Jour., Vol. 21, p. 31, (Jan. 1949).

(15) The Determination of Phenol and Structurally Related Compounds by the Gibbs Method. M. B. Ettinger and C. C. Ruchhoft. Analytical Chemistry, Vol. 20, p. 1191, (Dec. 1948).

(16) Review of Literature on Stream Pollution for 1948. C. C. Ruchhoft. Sewage Works Jour., 21, p. 254 (March 1949).

(17) Removal of Phenols and Cresols from Natural Waters. M.B. Ettinger and C. C. Ruchhoft. Ind. and Eng. Chem. 41, p. 1422 (1949).

(18) Water Quality Requirements for Recreational Uses. A. F. Stevenson. Sewage Works Jour. Vol. 21, p. 110 (1949).

(19) International Joint Commission Study of the Detroit River. M.LeBosquet,Jr. Sewage Works Jour., Vol. 21 (May 1949).

Papers in Press

(1) Studies on Household Sewage Disposal Systems. S.R. Weibel, C.P. Straub and John E. Thomas. Public Health Service.

(2) Factors to be Considered in Testing Quaternary Ammonium Compounds. L. A. Black. Jour., Milk and Food Technol. Vol. 12: (1949).

(3) Comparative Analysis of the Standard Methods Methylene Blue Stain and advantages of the Polychrome and Acid-and-Water-Free Stains in the Direct Microscopic Examination of Milk. B. S. Levine and L. A. Black. Amer. Jour. of Pub. Health, 39: (1949).

(4) The Effect of Copper and Chromatic Ions on the B.O.D. of Sewage Dilutions. O. R. Placak, C.C. Ruchhoft and R. G. Sharp. Ind. & Eng. Chem.

(5) A Dichromate Reflux Method for the Determination of Oxygen Consumed and its Effectiveness in the Oxidation of Organic Compounds in Dilute Solution. W. Allan Moore, Robert C. Ehmer and C. C. Ruchhoft.

(6) The Possibilities of the Disposal of Radioactive Waste by Biological Treatment Methods. C. C. Ruchhoft. Sewage Works Journal.

(7) Effect of Reservior Operation on Stream Water Quality. R. L. Woodward and H. LeBosquet, Jr. Public Health Reports. 39: (1949).

(8) Disposal of Wastes from Cation Exchange Softeners. P. D. Haney. Jour. American Water Works Assn., 41: (1949).

(9) Statistical Summary of Sewage Works Practice in the United States. J. R. Thomas, Public Health Reports.

(10) The Role of the Aquatic Biologist in a Pollution Abatement Program, C. M. Tarzwell. Transactions of American Fisheries Society.

Special Reports and Memoranda

(1) Kansas River Basin Water Pollution Investigation.

(2) Preliminary Report - Tri State Survey of Lake Michigan Waters (bathing waters).

(3) Monetary Benefits from Low Flow Regulation in the Allegheny-Monongahela Basin.

(4) Verdigris River Investigation - Woodsdale, Kansas to Nowata, Oklahoma.

(5) Interim Report - South Platte River Water Pollution Investigation.

(6) Inventory of Water and Sewage Facilities in the United States - 1945.

(7) Preliminary Investigation of Kraft Mill Wastes, Crossett Paper Mills, Crossett, Kansas, as related to Ouachita River Pollution in Vicinity of Arkansas-Louisiana State Line.

(8) Reports on Investigations Involving Laboratory Work at the Following Industrial Plants in the Niagara River Area:

(a) Durez Plastics and Chemicals, Inc.
(b) Hooker Electrochemical Company (chlorinated products)
(c) Mathieson Chemical Corporation (chlorine)
(d) Semet-Solvay Division, Allied Chemical and Dye Corporation (by product coke)
(e) Wickwire Spencer Steel Division, Colorado Fuel and Iron Corporation

(9) Progress Report on International Joint Commission on Lake Erie-Lake Ontario, Niagara River Boundary Water Pollution Investigation.

(10) Supplemental Report to Report of Special Committee to the Board of Technical Advisors, I. J. C., Re: Dredging at Strawberry Island (U. S. Section).

(11) Interim Report to International Joint Commission on Lake Huron-Lake Erie Section and Lake Superior-St. Mary's Section of Boundary Water Pollution Investigations. (U. S. Section).

(12) Report on Water Hyacinth Investigations.

(13) Report on Turtle Creek Investigation.

(14) Report on Special Studies of U. S. Hopper Dredge "Sevannah" Operations on Detroit and Rouge Rivers.

(15) Report of Cincinnati Pool Hearing Committee of Ohio River Valley Water Sanitation Commission on Investigations Leading to Recommended Treatment Standards for Organic Wastes Discharged into Cincinnati Pool (Committee member participation)

(16) Report of Special Engineering Committee of Ohio River Valley Water Sanitation Commission on Adequacy of Treatment Proposed by Allegheny County Sanitary Authority. (Committee member participation).

(17) Preliminary Report on Sanitary Benefits Due to Low Flow Regulation on Westfield River, Massachusetts, by Knightville Reservoir.

(18) Review of James River Investigation with Reference to Proposed Cathright Reservoir.

(19) Report on Chattahoochie River Investigation - Flow Requirements for Pollution Abatement Below Atlanta, Georgia.

(20) Memorandum - Use of Silver as a substitute for chlorine in swimming pools with 31 references.

(21) Memorandum - Detailed analysis of the "Waterloo Process".

(22) Memorandum - Transmission of disease through communal laundries.

(23) Discussion of Possible Causes of Fish Mortality in the Conasauga River, Georgia, and Comments on Van Horn Report.

(24) Outline of Proposed Toxicity Bio-assay Procedures for Evaluation of Acute Toxicity of Waste Waters and their Components to Fish.

(25) A Study of the Disposal of Cyanide and Other Wastes for the Bureau of Ordnance - Navy Department.

(26) Analytical Methods for Foundry Wastes. (U. S. Steel)

(27) Memorandum - Determination of Cadmium, Chromium and Cyanide.

(28) Memorandum - Treatment of Plating Wastes.

REPRESENTATION ON COMMITTEES

American Chemical Society	
Division of Water, Sewage, and Sanitation Chemistry	C. C. Ruchhoft
American Public Health Association	
Standard Methods Committee for the Examination of Milk and Milk Products	Dr. L. A. Black Referee
Shellfish Committee of the Laboratory Section	Elsie Wattie
	C. T. Butterfield
Advisor to Committee on Shellfish of the Engineering Section	C. T. Butterfield
Committee on Sewage Disposal of Engineering Section	C.C. Ruchhoft
	H.LeBosquet,Jr.
Committee on Rural Sanitation of Engineering Section	P. D. Haney
	S. T. Weibel
American Society for Testing Materials	
Committee D-19 on Water for Industrial Uses Sub-section VII Water Borne Industrial Wastes	C. C. Ruchhoft
American Water Works Association	
Committee on Disposal of Waste from Water Purification and Softening Plants	P. D. Haney
Citizens' Anti-Pollution Committee (Cincinnati, Ohio)	
Sub-Committee to Publicize Rogwood Control	J. S. Wiley, Chairman
Conference of Health and Municipal Public Health Laboratory Directors	
Committee on Location and Approval of Laboratories	Dr. L. A. Black
Committee on Laboratory Quarters and Equipment	Dr. L. A. Black
Federation of Sewage Works Associations	
Committee on Standard Methods of Sewage and Industrial Waste Analyses	L. R. Setter
	C. C. Ruchhoft
Research Committee	L. R. Setter
	C. C. Ruchhoft

Federation of Sewage Works Association (cont'd)

Sub-Committee on Toxicity of Industrial Wastes

Section I. Critical Review of Literature	P. Doudoroff
Section II. Development of Methods for Toxicity Determinations on Wastes	C.C.Ruchhoft
Section III. Development and Standardization of Biology Methods	P. Doudoroff, Chairman

International Association of Milk and Food Sanitarians

Committee on Applied Laboratory Methods Committee	Dr. L. A. Black, Chairman

International Joint Commission

Secretary to the U. S. Section of the Board of Technical Advisors	M.LeBosquet

Joint Committee on Rural Sanitation — S. R. Weibel

National Committee on Radiation Protection

Sub-Committee on Waste Disposal and Decontamination	C.C. Ruchhoft

National Sanitation Foundation

Technical Committee on Dishwashing, Detergent, Testing and Performance	F. I. Norris
Committee on Detergents and Sanitizers	C. W. Chambers

Ohio River Valley Water Sanitation Commission

Represents Surgeon General and Serves on the Executive and Engineering Committees	M. LeBosquet

Sanitation Study Section, Division of Research Grants and Fellowships, National Institutes of Health

Water and Sewage Sub-Committee	C. C. Ruchhoft, Chairman

Steering Committee for Development of Uniform Well Construction Standards — A. E. Stevenson

Wildlife Society

Employment Committee	Dr. C.M.Tarzwell